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THREE NEW MONOSPECIFIC GENERA OF POLYGONACEAE SUBFAMILY ERIOGONOIDEAE FROM CALIFORNIA

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ABSTRACT

Three new monospecific genera of Polygonaceae subfam. Eriogonoideae are proposed for species typically placed in *Chorizanthe* or *Centrostegia*: *Aristocapsa* is established for *C. insignis* of west-central California, *Systenotheca* for *C. vortreidei* of the Santa Lucia Range, and *Dodecahema* for *C. leptoceras* of southern California. Each genus is described, its geographic distribution outlined and representative specimens cited.

KEY WORDS: Polygonaceae, *Aristocapsa, Centrostegia, Chorizanthe, Dodecahema, Mucronea, Systenotheca*, California.

INTRODUCTION

Ongoing work on the subfamily Eriogonoideae Meisner (Polygonaceae Juss.) has resulted in revisionary treatments of various genera. To date *Stenogonum* Nutt. (Reveal & Ertter 1977a), *Goodmania* Reveal & Ertter (1977b), *Nemacaulis* Nutt. (Reveal & Ertter 1980), and *Oxytheca* Nutt. (Ertter 1980) have been reviewed. Numerous papers on *Eriogonum* Michx. have been published (see Shields & Reveal 1988 for a recent review), but as yet no revision of the entire genus has appeared.

The papers presented in this volume of *Phytologia* are an outgrowth of a series of requests to prepare floristic treatments of the eriogonoid genera. It is the first by the senior author to deal with *Chorizanthe* R. Br. ex Benth. and those genera most closely related to it, specifically *Mucronea* Benth., *Centrostegia* A. Gray ex Benth. in A. DC., and *Lastarriaea* Rémy in Gay. In this paper three new monospecific genera are proposed for the atypical species generally placed in *Centrostegia*. Reviews of the annual species of *Chorizanthe* (Reveal & Hardham 1989) and related genera (Reveal 1989) are presented elsewhere in this volume.

The genus *Centrostegia*, typified by *C. thurberi*, was defined initially by Goodman (1934) to include two additional species: *C. vortreidei* (Brandegee) Goodman and *C. leptoceras* (A. Gray in Torr. & A. Gray) Goodman. *Chorizanthe insignis* Curran was transfered to *Centrostegia* by Heller (1910), but placed in *Oxytheca* by Goodman (1934) a view later rejected

(Goodman 1957; Ertter 1980). All four species are markedly distinct morphologically and our cytological studies have shown that each is unique. The retention of these species in *Chorizanthe* (Abrams 1944; Munz 1959) can not be supported given the recognized distinctiveness of the species, the independent origin of each, and the polyphyletic nature of *Chorizanthe* when circumscribed in a broad sense. Accordingly, *Chorizanthe* is broken up into several genera. Now the equally polyphyletic genus *Centrostegia* as envisioned by Goodman (1957) is recast with each of its members placed in a monospecific genus.

Taxonomy

Aristocapsa Rev. & Hardham, gen. nov.–Type: *Aristocapsa insignis* (Curran) Rev. & Hardham.

Differt a ceteris Eriogonoideae aristis rectis et divergentibus in 5-lobatis turbinatis involucris praeditis floribus pro parte maxima sex; unicusintus Eriogoneae cum chromosomatum numerus $n = 14$.

Erect, glandular, annual herbs arising from a slender taproot; *leaves* basal, linear-spatulate, glabrous, tapering to an indistinct, winged petiole; *flowering stems* erect, dichotomous; *branches* open, spreading, dichotomotously branched throughout; *inflorescences* open, sparsely branched due to suppression of the secondaries; *bracts* mostly ternate, all basally connate and long awned, those of the first node usually 4 and surrounding it, those of the upper nodes opposite the solitary involucre, oblong to linear-acicular and often recurved; *peduncles* short and stout, often obscured by the bract; *involucres* solitary, narrowly turbinate, weakly ribbed and faintly corrugate, 5-lobed and long awn-tipped, the awns divergent, thick and rigid to slender and spine-like; *flowers* (4) 6 per involucre, short pedicellate, white to pink or rose, pubescent with long curled hairs, the tepals 6, petaloid, oblong; *stamens* 9, exserted, the filaments glabrous, the anthers oblong, maroon to red; *achenes* light greenish-brown to tan, the globose base tapering to a stout, 3-angled beak, the embryo curved, in abundant endosperm; $n = 14$.

Aristocapsa insignis (Curran) Rev. & Hardham, comb. nov. *Chorizanthe insignis* Curran, Bull. Calif. Acad. Sci. 1: 275. 1885. *Centrostegia insignis* (Curran) A. Heller, Cat. N. Amer. Pl. ed 3, 97. 1910. *Oxytheca insignis* (Curran) Goodman, Ann. Missouri Bot. Gard. 21: 91. 1934.–Type: Indian Valley, Monterey Co., California, Jun 1885, *Curran s.n.* (holotype: CAS!; isotypes: GH, ISC, NY, UC!).

Plants 2-10 cm tall; *leaves* (0.3) 0.5-1.5 cm long, (1) 2-4 mm wide; *peduncles* 1-2 mm long; *involucres* 3-5 mm long, the awns (1) 2-3 mm long; *flowers* 1.5 mm long, on pedicels 2-3 mm long; *stamens* with filaments 1.5-2 mm long and anthers 0.3-0.4 mm long; *achenes* 1.5 mm long; $n = 14$.

Sandy soil in the Coast Ranges of Monterey and San Luis Obispo cos., California, 1100-1800 ft elev; flowering May-Jul.

Representative Specimens.–UNITED STATES. California: Monterey Co.: Jolon, 1 Jul 1893, *Eastwood s.n.* (CAS); Jolon, Jun 1892, *Vortriede s.n.* (UC, US). San Luis Obispo Co.: 7 mi E of La Panza, 8 May 1926, *Eastwood & Howell 2345* (CAS); NE spur of Black Mountain, La Panza Range, 13 Jun 1956, *Hardham s.n.* (CAS); N of Nacimiento River at Triquerro Crossing, 3 Jun 1956, *Hardham 846* (CAS); between San Juan River and Carriza Plains on the Paso Robles-Simmler Road, 13 May 1960, *Hardham 5681* (CAS, RSA, SBBG, UC); between San Juan River and Carriza Plains, 2 Jun 1946, *Hoover 6135* (CAS, DAO, OBI, OKL, RSA, SD, UTC); along California

Highway 58, 0.6 mi E of San Juan Creek between La Panza and Carrisa Plains, 26 May 1988, *Reveal 6904* (BM, BR, BRY, CAS, CLEM, G, K, KW, LE, MARY, MEXU, MO, NY, OKL, OSC, RM, RSA, SMU, US, UTC, VT, WIS, Z). A total of 18 collections are known to us.

Aristocapsa (Latin *arista*, awn, and *capsa*, box or case, alluding to the awned involucre) may be distinguished from other genera in the subfamily by a combination of features, notably the terminally straight-awned 5-lobed narrowly turbinate, rigid and corrugated involucral tube, reduced 3-lobed alternate bracts that are long awned, mostly six flowers per involucre, nine stamens, peg-like peduncles subtending the involucre, and a curved embryo. *Aristocapsa insignis* (Latin *insignis*, remarkable, as to the unusual morphology relative to other known species), with a chromosome number of $n = 14$ (voucher: *Reveal 6904*; see also Hardham 1989 for additional vouchered reports), represents a unique, derived aneuploid from the *Chorizanthe*-based group characterized by a base number of $x = 10$ (Reveal & Moran 1977; Shields & Reveal 1988). Only *Pterostegia drymarioides* Fischer & C. A. Meyer, a member of the Pterostegieae, have a similar chromosome number.

The new genus is not obviously related to any other extant genus and may be easily distinguished from *Oxytheca* (which is consistently $n = 20$) as defined by Ertter (1980). The 3-lobed alternate bract places *Aristocapsa* near *Mucronea* and *Centrostegia*, but while both of those genera have a chromosome number of $n = 19$, only *Centrostegia* has a curved embryo. Furthermore, both of those genera have only one or two flowers per involucre.

Systenotheca Rev. & Hardham, gen. nov.—TYPE: *Systenotheca vortriedei* (Brandegee) Rev. & Hardham.

Differt a ceteris Eriogonoideae involucris 4-angulibus et 4-lobatis cum terminibus aristis praeditis duo floribus, uno perfectis alter femineis; chromosomatum numerus $n = 19$ (20).

Spreading, sparsely glandular annual herbs arising from a slender taproot; *leaves* basal, spatulate, glabrous, tapering to a broadly winged petiole; *flowering stems* erect, dichotomous; *branches* open, spreading, dichotomotously branched throughout; *inflorescences* cymose; *bracts* 3-4, connate and perfoliate, mucronate, those of the lower nodes usually 4-lobed, those at the upper nodes 3-lobed, the segments oblong to triangular, spreading to recurved; *peduncles* lacking; *involucres* solitary, turbinate, distinctly 4-angled and 4-lobed, the lobes united half to three-quarters of their length, spreading, mucronate, the base ventricose and sharply angled; *flowers* 2 per involucre, polygamo-dioecious, the upper shorter one perfect, the lower longer one female, the lobes white to pink or rose, glabrous but the outer surface densely papillate, the floral tube yellow and glabrous, the tepals 6, petaloid, apically bilobed, united only at the very base; *stamens* 9, exserted, the filaments glabrous, the anthers oblong, maroon to red; *achenes* dimorphic, those of the female flower short and included, those of the perfect flower elongated and exserted forming a dark brown to black fruit, its globose base tapering to a stout, 3-angled beak, the embryo curved, in abundant endosperm; $n = 19$ (20) (Hardham 1989).

Systenotheca **vortriedei** (Brandegee) Rev. & Hardham, comb. nov. *Chorizanthe vortriedei* Brandegee, Zoe 4: 158. 1893. *Centrostegia vortriedei* (Brandegee) Goodman, Ann. Missouri Bot. Gard. 21: 91. 1934.—TYPE: Santa Lucia Mountains, Monterey Co., California, Jul 1892, *Vortriede s.n.* (holotype: CAS!; isotype: UC!).

Plants 0.2-1.5 dm tall; *leaves* (1) 2-5 cm long, (4) 4-10 mm wide; *involucres* 2.5-4 mm long; *flowers* polygamo-dioecious, the upper perfect one 1-1.5 mm long, rose to pink, exserted

beyond the involucral tube on an elongated pedicel, the lower female one 2-2.5 mm long, white, included within the tube on a short pedicel; *stamens* with filaments 2-3 mm long and anthers 0.2-0.3 mm long; *achenes* 2-2.5 mm long; $n = 19$ (20).

Sandy soil of granitic, volcanic, calcareous or occasionally serpentine origin in the Santa Lucia Mountains of Monterey and San Luis Obispo cos., California, 2500-5250 ft elev; flowering May-Jul.

Representative specimens.—UNITED STATES. CALIFORNIA: Monterey Co.: canyon of Arroyo Seco River, Santa Lucia Mountains, 10 May 1936, *Eastwood & Howell 2428* (CAS, GH, K, RSA); Tassajara Hot Springs, Jun 1901, *Elmer 3244* (DS, G, K, MIN, MO, US, Z); Los Burros Creek near Nacimiento River, 29 May 1960, *Hardham 5926* (CAS, RSA, SBBG); summit of Pinyon Peak, 7 Jul 1955, *J.T. Howell 30522* (CAS, NY, RSA, US, W); Hanging Valley, 8 Jul 1955, *J.T. Howell 30649* (CAS, GH, OKL, RSA, US); S end of Hanging Valley, 15 Jun 1987, *Reveal & Broome 6460* (CAS, MARY, MICH, MO, NY, RSA). San Luis Obispo Co.: between Bee Rock and the Nacimiento River, 7 May 1958, *Hardham 3229* (CAS, DAO, RSA, SBBG); Burnett Peak Sargent Cypress Forest, 1 Jun 1960, *Hardham 5948* (BRY, CAS, RSA, SBBG, UC); 4 mi W of Ocean View Mine, 17 May 1961, *Hardham 7052* (CAS, RSA, SBBG, UCSB); Franklin Creek, W of Adelaida, 26 May 1961, *Hardham 7135* (B, CAS, DAO, E, W); 19.1 mi from California Highway 1 along San Simeon Creek Road, N of Rocky Butte Lookout, 27 Apr 1985, *Keil et al. 18663-1* (OBI). A total of 25 collections are known to us.

The new genus is most closely related to *Mucronea*. In its involucral and bract features, it is most similar to *M. perfoliata* (A. Gray) A. Heller. Nonetheless, *Systenotheca* (Greek *systenos*, tapering to a point, and *theke*, case, alluding to the tips of the elongated lobes of the box-shaped involucre) may be distinguished by its unique, 4-angled, 4-lobed, terminally awned, box-like involucres bearing polygamo-dioecious flowers, one perfect and one female, and its curved rather than straight embryo.

Polygamo-dioecious flowers are not otherwise known in the *Chorizanthe* line in the tribe Eriogoneae Torr. & A. Gray. The two flowers are individually colored, with the perfect one bearing reddish tepals while the female one has only white; both are yellow at the base. The latter flower may be functionally sterile as no mature achenes have, as of yet, been observed in it. Furthermore, it is likely that it is never exserted beyond the throat of the involucre and could only be cross pollinated when the upper, exserted, perfect flower has been removed.

The involucre of *Systenotheca vortriedei* (named for William Vortriede, 1861-1940, landscaper and California state gardener from 1911 until 1936 who was responsible for the landscaping of the state capitol grounds and numerous California high schools) is seemingly derived from the fusion of bracts through the reduction of the branching system. Each lobe has a distinct midrib and the tube is the most rigid of any in the subfamily. The 4-lobed condition is found in *Mucronea*, and it too is somewhat squared in cross-section. The involucres of both *Systenotheca* and *Mucronea* are sharply angled basally, and while ventricose, neither is saccate as is the case in *Centrostegia*.

Dodecahema Rev. & Hardham, gen. nov. *Centrostegia* A. Gray ex Benth. in A. DC. sect. *Diplostegia* Roberty & Vautier, Boissiera 10: 91. 1964.—TYPE: *Dodecahema leptoceras* (A. Gray in Torr. & A. Gray) Rev. & Hardham.

Differ a ceteris Eriogonoideae involucris dodecaristatis et sex lobis praeditis tres floribus; chromosomatum numerus $n = ca\ 17$.

Spreading, sparsely glandular annual herbs arising from a slender taproot; *leaves* basal, narrowly oblanceolate, glabrous, tapering to an indistinctly winged petiole; *flowering stems* erect, dichotomous; *branches* open, spreading, dichotomotously branched throughout with spiciform secondary branches bearing numerous, closely congested involucres; *inflorescences* cymose; *bracts* 3-4, united about half their length, those of the lower nodes usually 4-lobed,

those at the upper nodes 3-lobed, all shifted to one side of the node and opposite the subsequent branch or involucre, sharply reflexed; *peduncles* short and peg-like; *involucres* solitary, cylindrical, the 6 lobes free or weakly fused along their margins, the terminal straight awns 6 and of unequal size, spreading to divergent, the basal uncinate awns 6 and of equal length; *flowers* 3 per involucre, white to pink, long pubescent without, the tepals 6, petaloid, entire, united only at the very base; *stamens* 9, exserted, the filaments glabrous, the anthers oblong, maroon to red; *achenes* dark brown to black, glabrous, the globose base tapering to a long, 3-angled beak, the embryo curved, in abundant endosperm; n = ca 17.

Dodecahema leptoceras (A. Gray in Torr. & A. Gray) Rev. & Hardham, comb. nov. *Centrostegia leptoceras* A. Gray in Torr. & A. Gray, Proc. Amer. Acad. Arts 8: 192. 1870. *Chorizanthe leptoceras* (A. Gray in Torr. & A. Gray) S. Wats., Proc. Amer. Acad. Arts 12: 269. 1877.–TYPE: plains of San Gabriel, Los Angeles Co., California, 1857, *Lobb 464* (holotype: K!; isotypes: CGE, GH!).

Plants 0.3-0.8 (1) dm tall; *leaves* (1) 1.5-4 (6) cm long, 2-4 (7) mm wide; *peduncles* 0.5-1 mm long; *involucres* 2-4 mm long; *flowers* 1.2-1.8 (2) mm long; *stamens* with filaments 0.6-1 mm long and anthers 0.4-0.5 mm long; *achenes* 1.7-2 mm long; n = ca 17.

Sandy to gravelly soil along the foothills of the San Gabriel Mountains in Los Angeles Co. east along the foothills of the San Bernardino Mountains of San Bernardino Co. then south in western Riverside Co. to near the San Diego Co. line, 700-2100 ft elev; flowering May-Jun.

Representative Specimens.– UNITED STATES. CALIFORNIA: Los Angeles Co.: Newhall, 20 May 1893, *A. Davidson s.n.* (RSA); San Fernando, 1 May 1914, *A. Davidson 2978* (MARY, RSA); Roscoe, 5 Jun 1906, *Eastwood 258* (CAS, GH, US); San Fernando Wash, 11 May 1913, *Eastwood 258* (CAS, GH, US); Big Tujunga Wash, N of the bridge, 8 May 1949, *E. Levine s.n.* (LA); Pocoima Canyon Wash, 19 Apr 1925, *Munz 9384* (POM); Santa Anita Wash, 26 Apr 1920, *Peirson 2113* (JEPS, OKL, RSA); West Fork of the San Gabriel River, 21 Jun 1921, *Peirson 2455* (ARIZ, JEPS, NO, OKL, RM, RSA). Riverside Co.: Elsinore, May 1901, *J. Abrams s.n.* (DS, Z); Temescal Canyon, E side of Indian Wash between Interstate 15 and Temescal Canyon Road, 19 Apr 1986, *Boyd 1692* (MARY, NY, RSA, UCR); San Jacinto River, 1 mi E of Valle Vista N of California Highway 74, 24 Apr 1980, *Krantz et al. s.n.* (OBI, UCR); San Jacinto Plains, Jun 1882, *Parish & Parish 829* (BR, F, G, LE, PH, US, WS, WU); along California Highway 75 at milepost 48, 3 mi E of Fairview Avenue in Valle Vista, 23 May 1988, *Reveal 6863* (BM, BRY, CAS, MARY, MO, OSC, RSA, US, UTC, WIS); Bautista Creek Canyon, San Jacinto Mountains, 14 Jun 1967, *Ziegler 158* (RSA, UCR). San Bernardino Co.: Arrowhead Springs, 18 Apr 1923, *Feudge 15* (POM); S of Highland on Orange Avenue toward Redlands, W of Orange, 27 May 1979, *Krantz s.n.* (UCR); Highland, May 1888, *Parish s.n.* (F, MO, POM, UC); near San Bernardino, 18 May 1895, *Parish 3646* (ARIZ, B, CAS, G, GH, LE, MIN, NDG, UC, US); San Bernardino Valley, 1 Jun 1905, *Parish 5388* (LA, MIN, NMC, ORE, PH, RM); Colton, 1881, *Parry 260* (E, F, K, NY, WIS); without location, 1876, *Parry & Lemmon 367* (F, GH, ISC, K, MIN, MO, NY, POM, VT); Cajon Canyon, 1 mi below "Blue Cut," 3 Jun 1950, *Roos 4822* (RSA, UCR, UCSB). Unknown Co.: without location data, 1881, *Parry 260* (B, BM, CAN, F, G, LE, MO, NEB, NY, ORE, POM, UC). A total of 67 collections are known to us.

Dodecahema (Greek *dodeka*, twelve, and *hema*, dart or javelin, alluding to the twelve awns on each involucre) may be readily distinguished by its six-lobed involucral body with the lobes free or at best only slightly fused by a thin membrane. Each lobe is terminated by a long, thin, *Oxytheca*-like awn. The basal set of six awns appears to have been derived from the fusion of two whorls of bracts. The lower awns are situated alternately with the upper ones, are just as thin, but are sharply curved upwardly near the apex so as to become hooked.

The chromosome number of *Dodecahema leptoceras* (Greek *leptos* thin, slender, and *keras*, horn, as to the thin awns) reported here (voucher: *Reveal 6863*) is still uncertain. We have consistently observed 15 pairs of chromosomes in meiosis. In all instances, however, there

are additional chromosomes, the number being about 17 in anaphase and telophase views. Even so, this number is not consistent and we have noted that not all pollen grains stain positive with cotton blue in lactophenol. Until additional populations are examined, the chromosome number must remain tentative.

We consider the range of this federally declared endangered species to be as given here and exclude the *Meiere s.n.* (CAS) collection from Needles, San Bernardino Co., gathered 4 May 1917. We consider it to be mislabelled.

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